Trend Study 25C-23-03

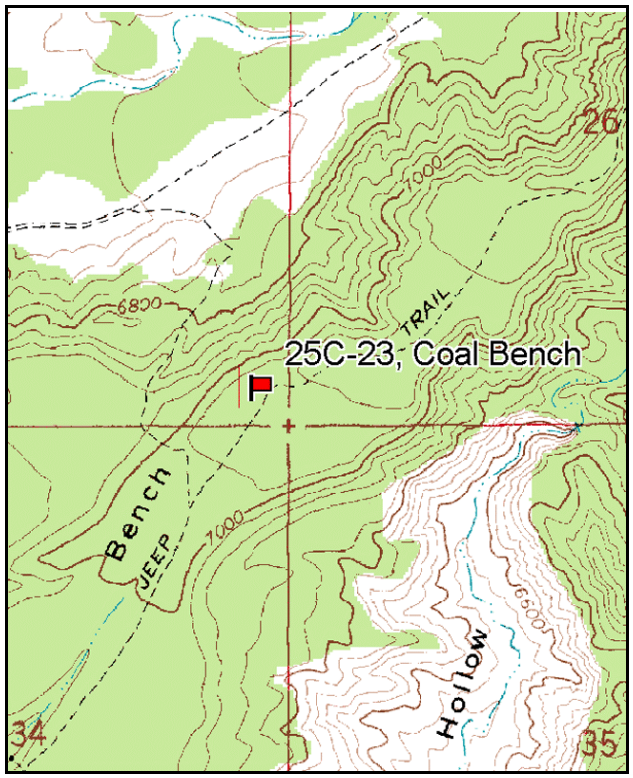
Study site name: Coal Bench . Vegetation type: Chained, Seeded P-J .

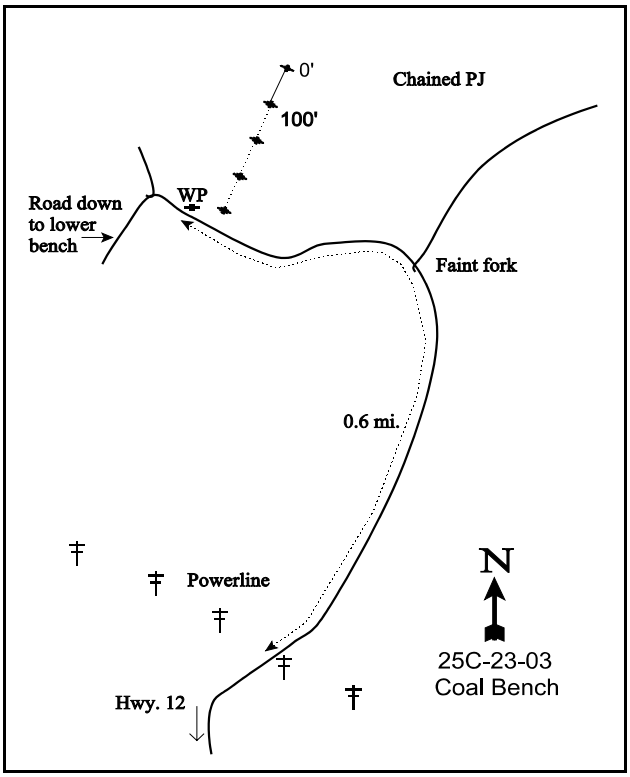
Compass bearing: frequency baseline 208 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

LOCATION DESCRIPTION

Take SR12 west of Escalante towards Henrieville. Go 0.5 mile past mile marker 33, then turn right (north) onto a dirt road which leads toward Coal Bench. Go to a fork (take left fork to cross the wash) and continue 0.3 miles to a gate. From the gate travel 2.0 miles to a fence at the top of the bench. Continue 0.6 miles to a fork, keep right. Continue 1.1 mile to a fence, then pass under the powerlines. Go 1.0 mile to a larger set of powerlines. Continue 0.6 miles to where the road bends and drops down onto a lower bench. There is a witness post (4 foot tall green fencepost) on the right side of the road. From the witness post, walk 100 feet at 114 degrees magnetic to the 400-foot stake. The 0-foot baseline stake, 400 feet northeast, is marked with browse tag #7139.





Map Name: Pine Lake

Diagrammatic Sketch

Township 36S , Range 2W , Section 34

GPS: NAD 27, UTM 12S 4165865 N, 413177 E

DISCUSSION

Coal Bench - Trend Study No. 25C-23

This trend study is located on the large Coal Bench mesa, below the Table Cliffs on a southwest point of the Aquarius Plateau. Most of the suitable acreage (3,500 acres) on Coal Bench has been chained and/or plowed and seeded. Treatments were completed in 1966. The transect is located on the narrow, northern end of upper Coal Bench at an elevation of 7,000 feet. The terrain is nearly level to gently sloping on a mostly south aspect. Deer use the area as a major spring and fall migration route from the Dixie National Forest to winter ranges further south. In mild winters, some deer stay in the area. Pellet group data taken during the 1991 reading estimated 14 deer days use/acre (35 ddu/ha). Data from 1998 estimated 7 deer and 4 cow days use/acre (17 ddu/ha and 10 cdu/ha). One elk pellet group was also found. Deer pellet groups were concentrated around cliffrose plants. Cow sign appeared old and possibly from the previous year ('97). Rabbit sign was abundant. Pellet group data from 2003 estimated similar light use at 7 deer, 2 elk, and 11 cow days use/acre (18 ddu/ha, 5 edu/ha, and 27 cdu/ha). Cattle use appeared to be from the previous grazing season ('02). This area is within a 3 pasture rest rotation grazing system with use occurring in the spring or summer.

The soil is relatively deep with an estimated effective rooting depth of almost 15 inches. At that depth, a hard pan layer was encountered which was impenetrable to the soil penetrometer. Soil texture is a sandy clay loam which is neutral in reactivity (pH 7.0). The soil was formed in alluvium from sandstone and shale. Phosphorus is low at only 4 ppm, when 10 ppm is considered to be the minimum value for normal plant development. Some areas have evidence of continued soil movement with rills, exposed plant roots, soil pedestalling and localized concentrations of pavement on the surface. However, erosion is not severe due to the gentle terrain.

Twenty years after the chaining, and prior to the 1998 reading, young (5-8 foot tall) pinyon and juniper trees were common on the site. Density did not appear great enough to effect understory plants in 1991. During the spring or early summer of 1998, prior to the 1998 reading, most of the pinyon and juniper trees were cut down with chainsaws. Point-quarter data estimated 14 pinyon and 24 juniper trees/acre still on the site. Of these, 1/3 of the juniper trees sampled were cut, but still living because they were not cut close enough to the ground. Pinyon had an average basal diameter of only 1 inch while uncut surviving juniper averaged 2.7 inches in diameter. Shrub density strip data estimated a total of 260 dead pinyon and juniper trees/acre that were killed by the treatment. Point-quarter data from 2003 estimated 13 pinyon and 14 juniper trees/acre with average basal diameters of 2.5 and 2.9 inches respectively. Eighty percent of the pinyon and 64% of the juniper trees sampled were in the 1 to 4 foot height class.

Black sagebrush is the most common browse species which makes up around 80% of the total browse cover. Density was estimated at 933 plants/acre in 1987 increasing to 4,599 by 1991. The much larger sample used in 1998 estimated 2,840 plants/acre. It appears that most of the change in density was caused by the decline in young plants. Mature plants actually increased from 1,233 to 1,660 plants/acre. Black sagebrush density numbered 3,620 plants/acre in 2003. Young recruitment has been good during all readings with the exception of marginal recruitment in 2003. Utilization has been mostly light to moderate with a few plants displaying heavy use. Use was heavier in 1991 when 64% of the shrubs sampled displayed moderate use. Vigor has been good during all readings and percent decadence has remained low.

Other preferred browse species consist of small numbers of curlleaf mountain mahogany and Stansbury cliffrose. Curlleaf was first picked up in 1998 with the larger sample. Cliffrose numbered an estimated 60 plants/acre. Many of these are 6 to 7 feet tall and mostly moderately utilized where available. Annual leader growth was good in 2003 averaging nearly 3 inches. Annual leaders were only found on plants which had received browsing use during the past winter. Most cliffrose was vigorous in 2003 and many were producing seed. Other browse found on the site include a few Wyoming big sagebrush, rubber rabbitbrush, bitterbrush,

and broom snakeweed.

The understory is productive but dominated by crested wheatgrass which provided 73% of the total vegetation cover in 1998. It provided 99% of the grass cover in 1998 and 2003. Heavy litter buildup is associated with these mature plants. The bunchgrass provides excellent soil protection where it occurs, but there is a lot of exposed soil between plants. Native grasses are uncommon. Forbs are rare and only the large-leaved *Cryptantha* was found more than occasionally.

1987 APPARENT TREND ASSESSMENT

Soil condition is good as herbaceous plants are abundant and well dispersed. Cover of bare ground is relatively high but erosion is not a problem due to the gentle terrain. The key browse is black sagebrush and cliffrose. Sagebrush is not abundant with a density of only 933 plants/acre. Seedling and young recruitment are good however, and the population appears to be expanding. The large cliffrose are moderately hedged where available. The small population appears stable with no seedling or young recruitment. The herbaceous understory is totally dominated by crested wheatgrass. Other grasses are uncommon. The forb component is diverse for a dry site like this, but only *Cryptantha* is found more than occasionally.

1991 TREND ASSESSMENT

There have been large changes in basic cover with only two characteristics that were positive. Vegetative basal cover increased (4% to 6%) and percent rock-pavement decreased (11% to 7%). The negative changes were litter cover declining (54% to 46%) and percent bare ground increasing (31% to 42%). These changes all indicate a downward trend for soils. Most of the more important browse species are in very low numbers, 66 plants/acre or less. The one key species that occurs in high numbers is black sagebrush. Density was estimated at 4,599 plants/acre, up from 933 plants/acre in 1987. Trend for browse is up for Coal Bench. The only common herbaceous species is crested wheatgrass and *Cryptantha*. The overall trend is slightly downward for the sum of nested frequency for both grasses and forbs is down and the nested frequency of crested wheatgrass has dropped significantly.

TREND ASSESSMENT
soil - down (1)
browse - up (5)
herbaceous understory - slightly downward (2)

1998 TREND ASSESSMENT

Trend for soil is up with a major decline in percent bare ground (42% to 27%). Litter cover also increased slightly. Trend for browse is considered stable. Density of the key species, black sagebrush, declined 38% due to a reduced number of young plants (3,233 to 1,060 plants/acre). There is still more than enough young plants to maintain the population at current levels. In addition, the number of seedlings has increased. Utilization of black sagebrush is mostly light, vigor good and percent decadence low at only 4%. Other preferred species, curlleaf mountain mahogany and cliffrose, have low but stable densities. Trend for the herbaceous understory is stable. Sum of nested frequency of crested wheatgrass has remained similar to 1991, while frequency of forbs increased slightly. Composition is poor with crested wheatgrass providing 94% of the herbaceous cover.

TREND ASSESSMENT
soil - up (5)
browse - stable (3)
herbaceous understory - stable, but poor composition (3)

2003 TREND ASSESSMENT

Trend for soil is down slightly. Average cover of bare ground has increased 38% while vegetation cover dropped 43%. Litter cover declined slightly. Erosion is not a problem however due to the gentle terrain. Trend for browse is up slightly for black sagebrush and stable for cliffrose. Black sagebrush increased 22% in density to 3,620 plants/acre. Use is similar and vigor is normal on most plants. The number of decadent plants did increase to 15% of the population but young sagebrush are abundant enough to maintain the stand. Cliffrose has remained at a density of 60 plants/acre. All are mature, treelike shrubs with an average height of 5 feet. Browsing is moderate where available. Vigor remains good but there is no sign of seedling or young recruitment. Overall, trend for browse is considered slightly up due to the increase in black sagebrush. Trend for the herbaceous understory is down. Sum of nested frequency of perennial grasses and forbs declined 41%. In addition, the 2 most abundant species, crested wheatgrass and *Cryptantha* declined significantly in nested frequency. Production also dropped dramatically. Average grass and forb cover declined 3 fold since 1998. This site appears to be quite dry and likely effected by the past few drought years. Weather data from Escalante shows below normal spring precipitation (April-June) for the past 4 years with exceptionally dry conditions in 2000 and 2002.

TREND ASSESSMENT
soil - down slightly (2)
browse - up slightly (4)
herbaceous understory - down (1)

HERBACEOUS TRENDS --
Management unit 25C, Study no: 23

Type	Species	Nested Frequency				Average Cover %	
		'87	'91	'98	'03	'98	'03
G	Agropyron cristatum	$_{c}$277	$_{b}$250	$_{bc}$249	$_{a}$151	16.34	5.03
G	Agropyron smithii	-	-	3	-	.01	-
G	Aristida purpurea	$_{a}$-	$_{a}$3	$_{a}$-	$_{b}$11	-	.05
G	Oryzopsis hymenoides	3	5	-	-	-	-
G	Sitanion hystrix	1	-	-	3	-	.00
G	Unknown grass - perennial	3	-	-	-	-	-
Total for Annual Grasses		0	0	0	0	0	0
Total for Perennial Grasses		284	258	252	165	16.35	5.08
Total for Grasses		284	258	252	165	16.35	5.08
F	Arabis demissa	-	4	-	-	-	-
F	Astragalus spp.	3	-	2	-	.03	-
F	Cruciferae	1	-	-	-	-	-
F	Cryptantha spp.	$_{ab}$40	$_{a}$32	$_{b}$57	$_{a}$22	1.06	.38
F	Gilia spp. (a)	-	-	-	-	.00	-
F	Ipomopsis aggregata	2	-	8	-	.02	-
F	Lesquerella intermedia	2	-	-	-	-	-
F	Lithospermum ruderale	6	-	-	-	-	-
F	Penstemon spp.	-	2	-	1	-	.03

Type	Species	Nested Frequency				Average Cover %	
		'87	'91	'98	'03	'98	'03
F	Phlox austromontana	2	3	3	1	.01	.00
F	Townsendia incana	2	1	-	-	-	-
Total for Annual Forbs		0	0	0	0	0.00	0
Total for Perennial Forbs		58	42	70	24	1.12	0.41
Total for Forbs		58	42	70	24	1.12	0.41

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS --
Management unit 25C, Study no: 23

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia frigida	0	0	-	.38
B	Artemisia nova	44	49	4.08	7.31
B	Cercocarpus ledifolius	2	0	.38	-
B	Chrysothamnus nauseosus	1	2	.00	.63
B	Cowania mexicana stansburiana	3	3	.53	.81
B	Gutierrezia sarothrae	1	16	-	.22
B	Juniperus osteosperma	1	1	-	-
B	Opuntia spp.	1	0	-	-
B	Pinus edulis	3	2	.03	.18
B	Sclerocactus	1	0	-	-
Total for Browse		57	73	5.03	9.54

CANOPY COVER, LINE INTERCEPT --
Management unit 25C, Study no: 23

Species	Percent Cover '03
Artemisia nova	5.90
Chrysothamnus nauseosus	.56
Cowania mexicana stansburiana	.70
Gutierrezia sarothrae	.08
Pinus edulis	.21
Purshia tridentata	.23

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 25C, Study no: 23

Species	Average leader growth (in) '03
Artemisia nova	1.5
Cowania mexicana stansburiana	2.9

POINT-QUARTER TREE DATA --
Management unit 25C, Study no: 23

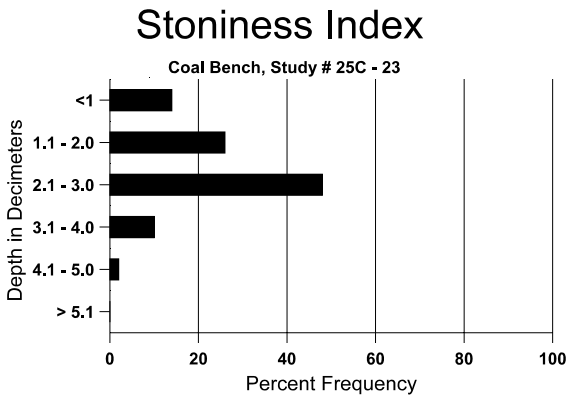
Species	Trees per Acre '98	Trees per Acre '03	Average diameter (in) '98	Average diameter (in) '03
Juniperus osteosperma	24	14	2.3	2.9
Pinus edulis	14	13	1.0	2.5

BASIC COVER --
Management unit 25C, Study no: 23

Cover Type	Average Cover % '87	'91	'98	'03
Vegetation	4.25	5.50	24.64	14.16
Rock	.50	1.50	.23	.36
Pavement	10.00	4.75	6.96	7.98
Litter	53.75	45.75	48.13	46.87
Cryptogams	.50	1.00	.87	.15
Bare Ground	31.00	41.50	26.76	37.06

SOIL ANALYSIS DATA --
Management unit 25C, Study no: 23, Study Name: Coal Bench

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	ds/m
14.9	64.3 (13.6)	7.0	54.0	19.4	26.6	4.6	4.0	76.8	0.5



PELLET GROUP DATA --
Management unit 25C, Study no: 23

Type	Quadrat Frequency '98	'03	Days use per acre (ha) '98	'03
Rabbit	42	33	-	-
Elk	-	3	1 (2)	2 (5)
Deer	20	9	7 (17)	7 (18)
Cattle	1	2	4 (10)	11 (27)

BROWSE CHARACTERISTICS --
Management unit 25C, Study no: 23

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
Artemisia nova											
87	**933**	3133	300	633	-	-	29	7	0	4	10/14
91	**4599**	33	3233	1233	133	-	64	2	3	0	8/10
98	**2840**	1000	1060	1660	120	120	18	6	4	0	11/17
03	**3620**	-	300	2760	560	140	15	.55	15	7	13/19
Artemisia tridentata wyomingensis											
87	**33**	-	-	33	-	-	0	0	-	0	26/16
91	**33**	-	-	33	-	-	100	0	-	0	20/27
98	**0**	-	-	-	-	-	0	0	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	0	31/44
Cercocarpus ledifolius											
87	**0**	-	-	-	-	-	0	0	0	0	-/-
91	**0**	-	-	-	-	-	0	0	0	0	-/-
98	**100**	-	-	60	40	-	0	0	40	0	5/8
03	**0**	-	-	-	-	-	0	0	0	0	-/-
Chrysothamnus nauseosus											
87	**33**	-	-	-	33	-	100	0	100	0	-/-
91	**0**	-	-	-	-	-	0	0	0	0	-/-
98	**20**	-	-	20	-	-	100	0	0	0	34/41
03	**40**	-	-	-	40	-	0	0	100	100	34/43
Cowania mexicana stansburiana											
87	**66**	-	-	66	-	-	100	0	-	0	84/96
91	**33**	33	-	33	-	-	0	0	-	0	93/107
98	**60**	-	40	20	-	-	0	0	-	0	74/73
03	**60**	-	-	60	-	-	67	0	-	0	62/61

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae											
87	**0**	-	-	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**20**	140	20	-	-	-	0	0	-	0	10/10
03	**540**	-	100	440	-	-	0	0	-	0	9/11
Juniperus osteosperma											
87	**0**	-	-	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**20**	-	20	-	-	40	0	0	-	0	-/-
03	**20**	-	20	-	-	-	0	0	-	0	-/-
Opuntia spp.											
87	**0**	-	-	-	-	-	0	0	0	0	-/-
91	**99**	-	33	33	33	-	0	0	33	0	4/8
98	**40**	20	-	40	-	-	0	0	0	0	5/13
03	**0**	-	-	-	-	-	0	0	0	0	-/-
Pinus edulis											
87	**33**	-	33	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**80**	20	80	-	-	220	0	0	-	0	-/-
03	**40**	-	40	-	-	-	0	0	-	0	-/-
Purshia tridentata											
87	**0**	-	-	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	0	17/24
03	**0**	-	-	-	-	-	0	0	-	0	23/30
Sclerocactus											
87	**0**	-	-	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**20**	-	20	-	-	-	0	0	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	0	-/-
Shepherdia rotundifolia											
87	**0**	-	-	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	0	75/108